

AS Unit BY2: Biodiversity and Physiology of Body Systems

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Topic 2.4 Reproductive Strategies – Page 2

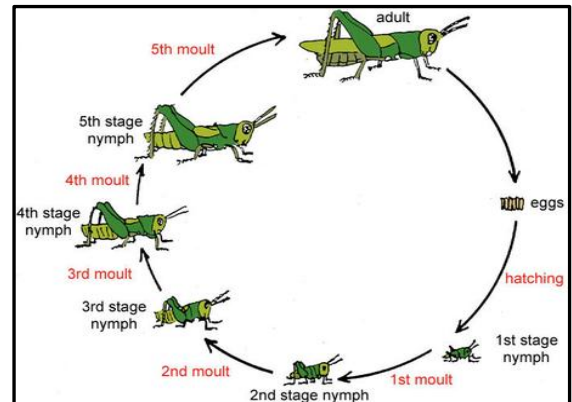
		Completed
1.	Read the notes in insect reproductive strategies p2-3 <ul style="list-style-type: none">• Complete the question on page 3	
2.	Read about plant reproductive strategies p4-6 <ul style="list-style-type: none">• Complete the questions on page 5 and 6	
3.	Make sure that you are clear about the similarities shown between animals and plants in terms of how they have adapted to evolve to life on land.	

Insects may account for between 80 and 90 percent of all animal species on Earth. They are an extremely diverse, abundant and widespread group of animals.

In the type of reproduction and development described so far the embryo develops directly into the adult. In some animals, however, the zygote develops into an intermediate form, either a nymph or a larva, before becoming an adult. The process by which it is transformed into the adult is called **metamorphosis**.

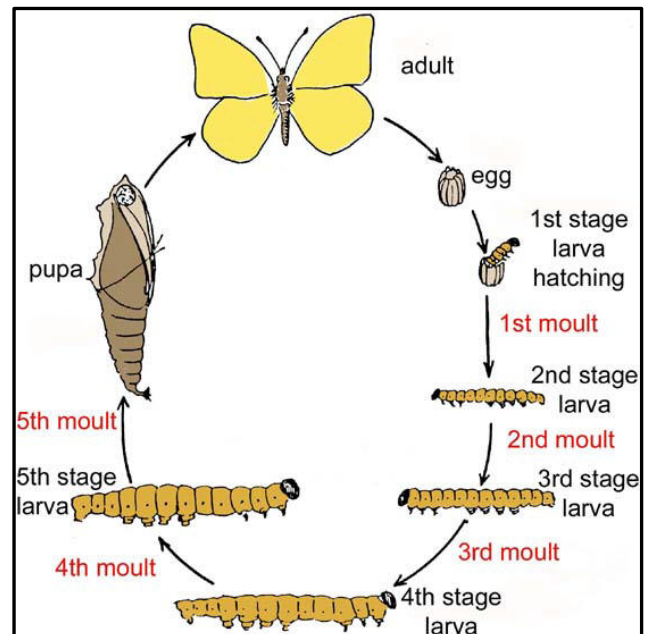
You need to know about two types of metamorphosis:

- **Incomplete Metamorphosis** – The eggs hatch into **nymphs**, which clearly resemble the adults except that they are smaller, lack wings and are sexually immature. There are a number of **nymphal stages** (instars) between which **moulting** occurs. Examples of insects that carry out incomplete metamorphosis are locusts and cockroaches.



The intermittent growth is made necessary by the cuticle (exoskeleton), which because of its hardness prevents the body from growing. Periodically the cuticle is shed, a process called **moulting (ecdysis)**. Only then, while the new cuticle underneath is soft enough to expand can any significant amount of growth take place. Some insects expand their abdominal cavity to stretch and obtain the greatest level of growth possible before the exoskeleton hardens.

- **Complete Metamorphosis** – The eggs hatch into larvae, which differ considerably from the adults. Each larva undergoes a series of moults until it changes its appearance and becomes a dormant stage known as a **pupa**. The pupa allows it to overcome any unfavourable conditions as well as giving time for the development of a more specialised adult. After much reorganisation of the tissues within the pupa, the adult (imago) emerges. Examples of insects that carry out complete metamorphosis are moths, butterflies and flies.



Functions of Larvae



Moths and Butterflies

Ladybirds

Dung beetle

Flour beetle

House Fly

To the left are some examples of the larval forms of some insects. Why have a larval form? One explanation is that it allows the species to exploit different food sources. Butterflies for example, feed on nectar as adults. This is only plentiful in the summer when flowers have developed. If an animal is to complete its lifecycle in a year, it needs to start as early as possible in the spring. At this time, flowers are likely to be in short supply and the total nectar available could not support the growth of offspring. As well as this nectar is almost all carbohydrate and would not provide the necessary protein for growth. The caterpillars of butterflies are adapted to feed on leaves. There is lots of this available in the spring and it contains some protein. Growth will occur rapidly and the caterpillar can pupate in time for adults to emerge in summer, when nectar is abundant.

- The mouthparts of the two stages are vastly different. The mandibles of the caterpillar are suited to biting the edges of leaves while the long tube like proboscis of the butterfly is adapted to reaching liquid nectar.
- Gut enzymes differ in the two stages, each being suited to its diet. Caterpillars produce protease, lipase, amylase, sucrose and maltase. Butterflies just produce sucrose.
- The butterfly has wings allowing it to disperse for reproduction, the caterpillar does not have wings.
- Only the butterfly form is capable of reproduction, the caterpillar form is not.

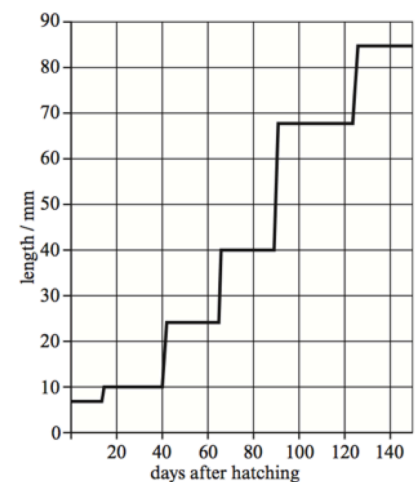
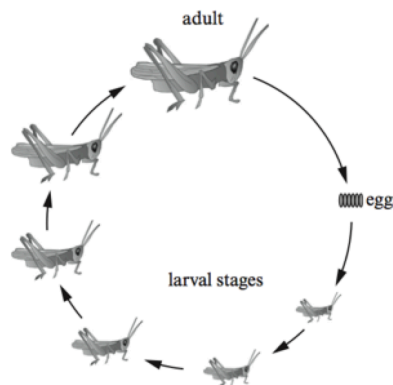
Insects are a group of organisms adapted to a terrestrial way of life.

The diagrams below show the stages in the life cycle of a locust and the length of the insect at different times following hatching.

Name the type of insect life cycle shown by the locust.

What name is given to the different larval stages shown in the diagram?

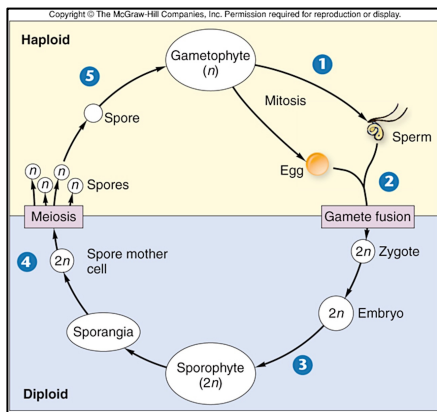
Use your knowledge and understanding of this type of insect life cycle to explain the changes in length of the insect following hatching.



Plant Reproductive Strategies

Alteration of Generations (this is just for information)

Seaweeds, mosses, liverworts and ferns share this life cycle.



In these organisms gametes are produced by mitosis from a haploid gametophyte (literally 'gamete' plant). The gametophyte is sexually mature and its gametes are haploid as you would expect. The gametes fuse to form a diploid zygote but this cannot, because it is diploid, develop into a new gametophyte. Instead it grows by mitosis into an organism called a sporophyte. The function of the sporophyte is to produce spores. Formed by meiosis, and therefore haploid, spores are small light and readily dispersed. When they land on a suitable surface, they will germinate and grow by mitosis into a gametophyte.

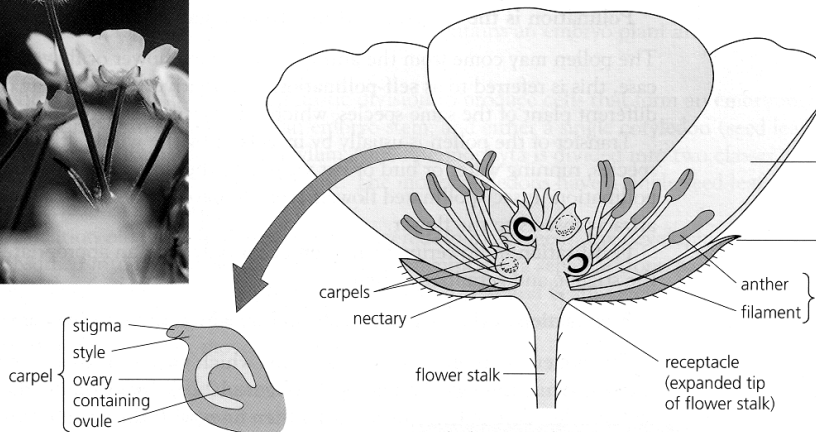
Mosses, liverworts and ferns are thought of as simple plants. They are generally small plants restricted to moist terrestrial habitats. They are restricted to damp habitats as their male gametes need a film of water to swim towards the female gametes and they also have poorly developed vascular tissue.

Angiosperms (flowering plants) form the dominant terrestrial vegetation today. They are found in a wide range of habitats. Flowering plants are well adapted to life on land because of their well-developed water-carrying xylem vessels (which also offer support and enable them to increase in size) and also their reproductive strategies, which have harnessed the wind, insects and other animals.

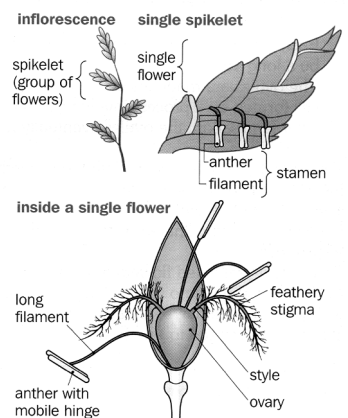
the inflorescence of buttercup (*Ranunculus acris*)



the buttercup flower in cross-section

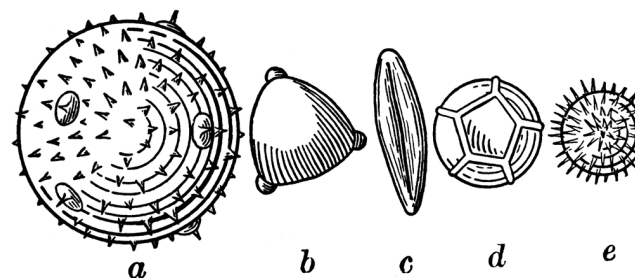


In the buttercup the nectaries occur one at the base of each petal.



The male gamete no longer relies on getting to the female gamete over a film of water but is contained within a pollen grain. Pollen grains have a hard outer covering, which protects the gamete both physically and from desiccation.

Transfer of the pollen grain to the female gamete takes place primarily through the use of insect or wind, in a process known as pollination.

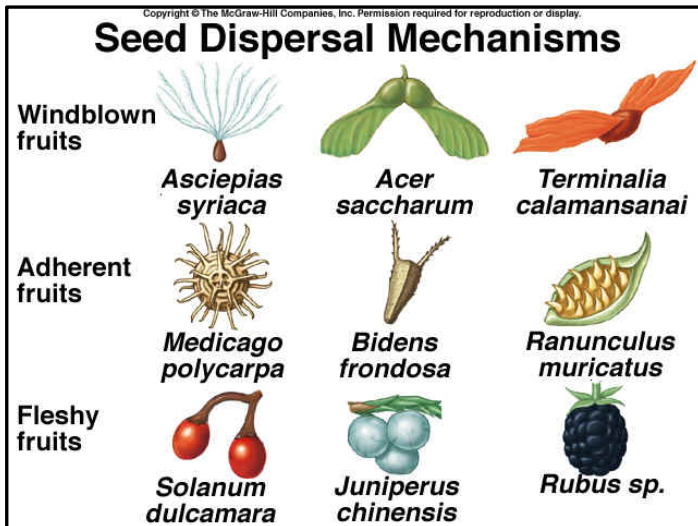


Another reproductive advantage of flowering plants is that the eggs are enclosed and protected within an ovary. After fertilisation of the seed the embryo then develops inside a seed, a structure with food reserves and a protective coat. One reason for the success of flowering plants is their ability to form successful relationships with animals, be it to help with pollination or seed dispersal.

The seed develops from the fertilised ovule and contains an **embryo plant** and a **food source**.

After fertilisation:-

- The zygote **grows by repeated mitotic division** to produce cells that form an embryonic plant, consisting of an **embryo root (radicle)**, an **embryo stem (plumule)**, and either a single **cotyledon (seed leaf)** or two cotyledons i.e. a monocotyledon or dicotyledon.
- Formation of food reserves** is triggered. In many seeds, the developing food store is absorbed into the cotyledons, rather than remaining as a separate store, packed around the embryonic plant e.g. beans and peas.



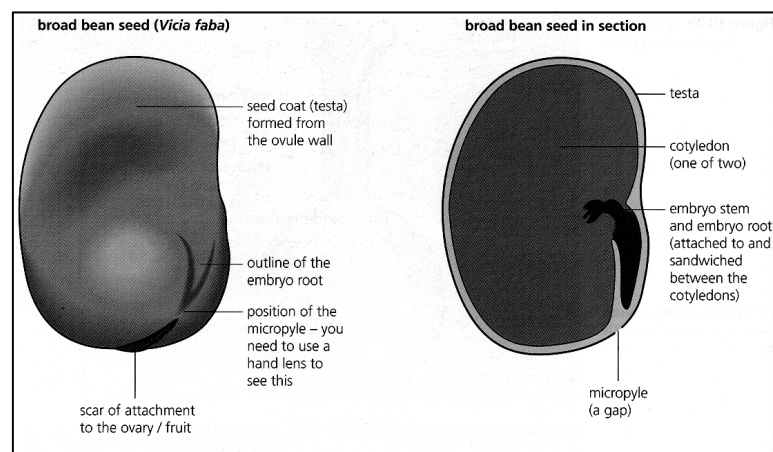
As the seed matures, the outer layers of the ovule become the protective seed coat or **testa** and the whole ovary develops into a **fruit**. Next, the **water content of the seed decreases**, and the seed moves into a **dormancy period**. In a mature, fully dormant seed, water makes up only 10-15% of seed weight.

The seed is now in a form, which will allow for successful dispersal. This is important as if the offspring seeds eventually germinate; it is helpful that they are some distance apart and away from the parent plant so there is more likelihood that they will not be competing for the same resources of space, water and light.

The plant structures, fruits, which aid in dispersal, have evolved in many different ways to exploit air currents, passing animals and flowing water to transport their seeds.

Complete the table below:

STRUCTURE	FUNCTION
Testa	
Micropyle	
Embryo root	
Embryo shoot	
Cotyledons	



Reasons for the Success of Flowering Plants

- **Short Life Cycle**

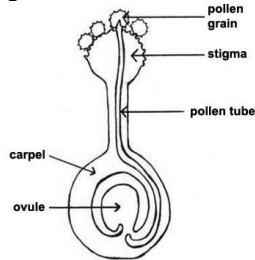
The time period between flower production and the setting of seeds into the ground is usually only a matter of weeks.

- **Relationships with Insects and Other Animals**

This has enabled them to distribute their hardy pollen grains without dependence of water. It has also allowed them to distribute their seeds away from the parent plant. This reduces competition and allows the colonisation of new ground.

- **Pollen Tube**

Once the pollen grain lands on the stigma of the female part of a flower, it uses a pollen tube to grow down and reach the female gamete.



- **Production of Seed with a Food Store and Testa**

The seed protect the embryo plant from desiccation. It can remain dormant in unfavourable conditions. It provides food for the embryo plant, this will support the embryo plant until it has grown sufficiently and its seed leaves can start to carry out photosynthesis.

- **Fertile Soil**

Most flowering plants are deciduous. Leafs will fall seasonally and minerals will be recycled back into the soil helping to provide optimum conditions for growth when the growing season starts again.

Compare the two life cycles shown below:

